Section 5

3D-TOP Overhead Support Operating Instructions

SIEMENS

Operating Instructions
3D-T.O.P. overhead support
with manual multileaf collimator

AX

CE
0123

RX22-040.621.01.02.02

Please observe

Safety operating instructions

Order No.: RX0-000.621.01

These must be studied exactly before system startup.

Important information from the manufacturer

CE marking

This product is provided with a CE marking in accordance with the regulations stated in Appendix II of the Directrive 93/42/EC of June 14th, 1993 concerning medical engineering products.

In accordance with Appendix IX of the Directrive 93/42/EC, this product is assigned to class II b.

The CE marking applies only to medical engineering products which have been put on the market according to the above-mentioned EC Directive relevant to the product concerned.

Unauthorized changes to this product invalidate this declaration.

The original version of this manual was written in the German language.

AX

Siemens AG, Medizinische Technik
Siemensstr. 1, D-91301 Forchheim, Germany
Registered offices: Berlin and Munich
Siemens AG, Wittelsbacher Platz 2, D-80333 München, Germany

Order No.: **RX22-040.621.01.02.02**
Printed in the Federal Republic of Germany
AG 12.97

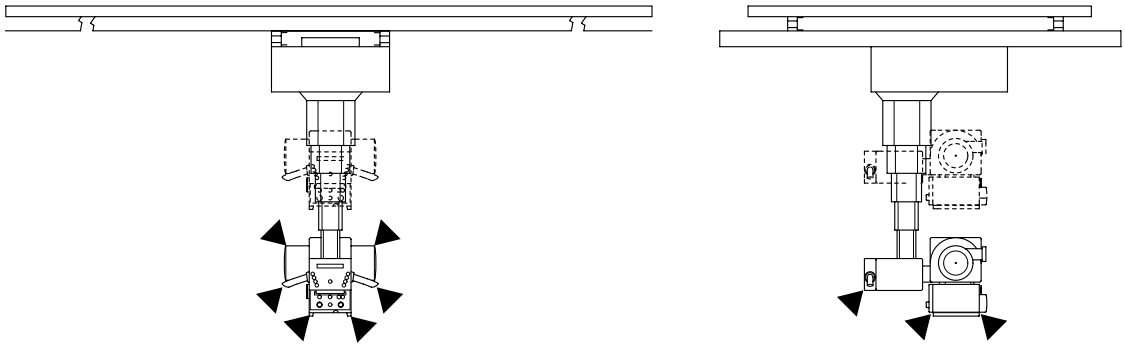
For notes

Protective measures

Mechanical safety

Collision and crushing hazard zones

- ❏ between persons, unit, Bucky wall stand, wall or objects and 3D overhead support during longitudinal or transverse travel or rotation of the x-ray tube unit around the vertical or horizontal axis
- ❏ if the 3D overhead support is moved outside of its defined parking area
- ❏ between persons and 3D overhead support during motor-driven travel of the patient positioning table
- ❏ between the hand grips of the 3D overhead support and the multileaf collimator during rotation of the multileaf collimator
- ❏ on the accessory rails of the multileaf collimator



▼ Operator and patient crushing hazard zones

Legally required checks

- Legally required checks such as the constancy test stipulated by §16 of the ordinance governing the use of radiation emitting equipment valid in the Federal Republic of Germany must be performed at the specified intervals.

Safety-relevant wearing parts

For reasons of safety, steel cables must be inspected and if necessary replaced at a time interval of least every three years.

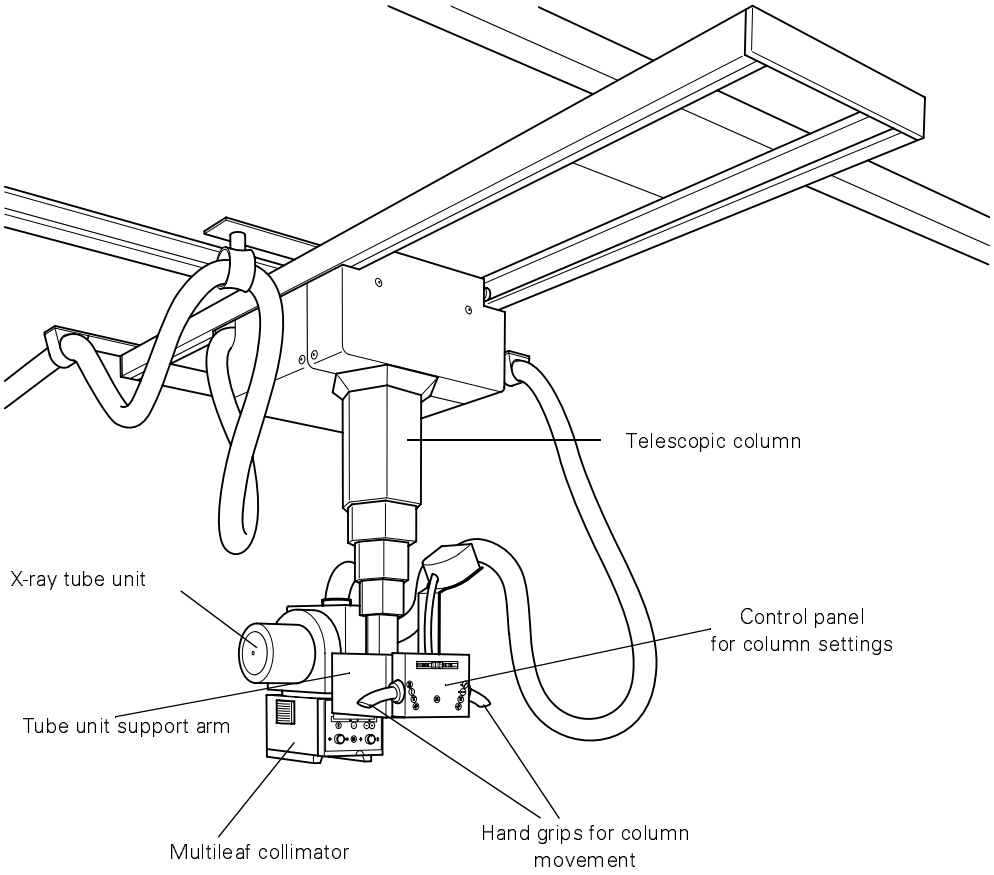
Maintenance intervals

In order to the system's safety and reliability performance, maintenance must be performed regularly, i.e. at intervals of max. every 12 months.

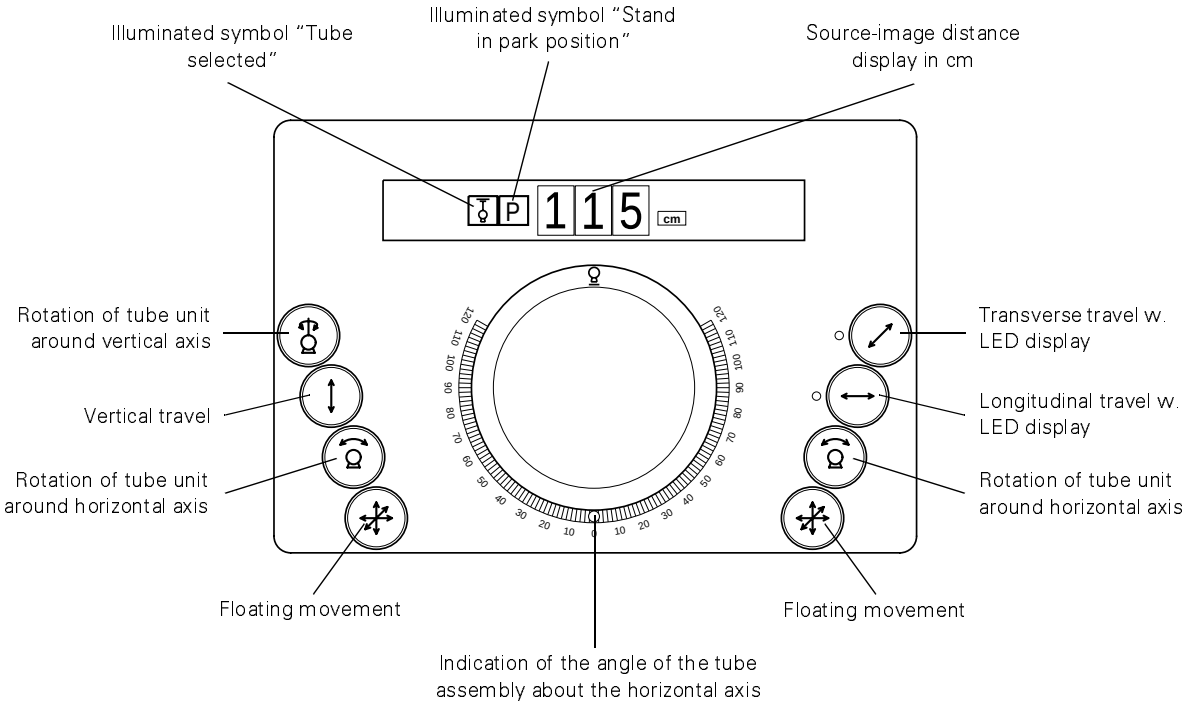
- If you have not yet concluded a maintenance contract, please contact SIEMENS Uptime Service.

Layout of control and display elements

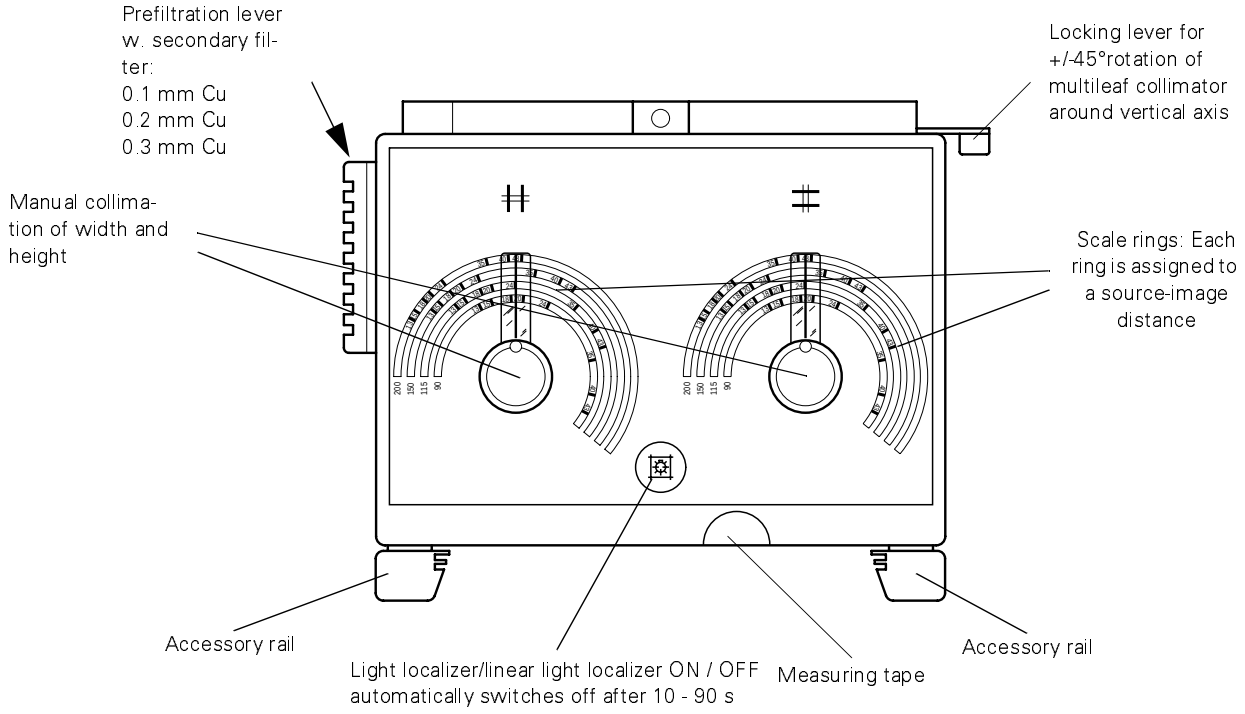
Location drawing



Control panel for column settings



Multileaf collimator

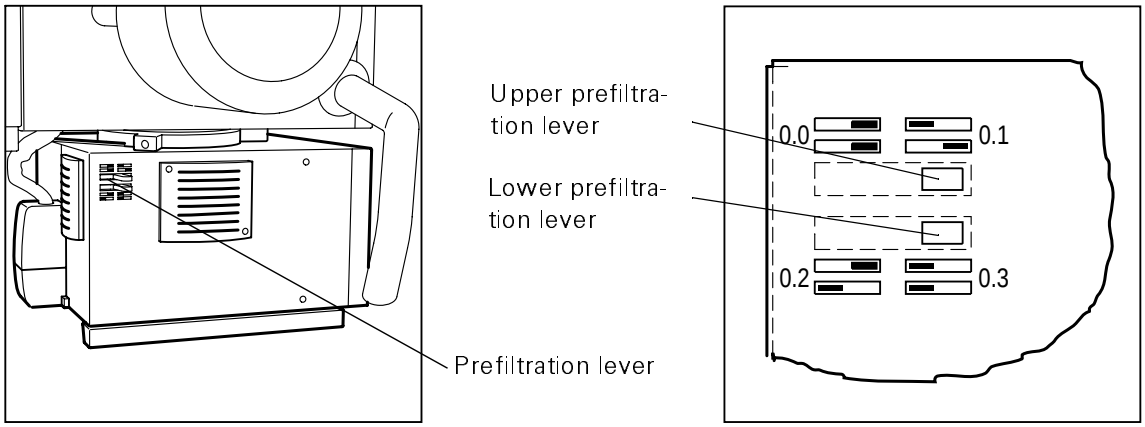


Multileaf collimator

Setting the prefiltration

Warning

Check the **setting of the prefiltration lever before each** exposure! Selection of the wrong filter may increase the radiation dose the patient is subjected to.



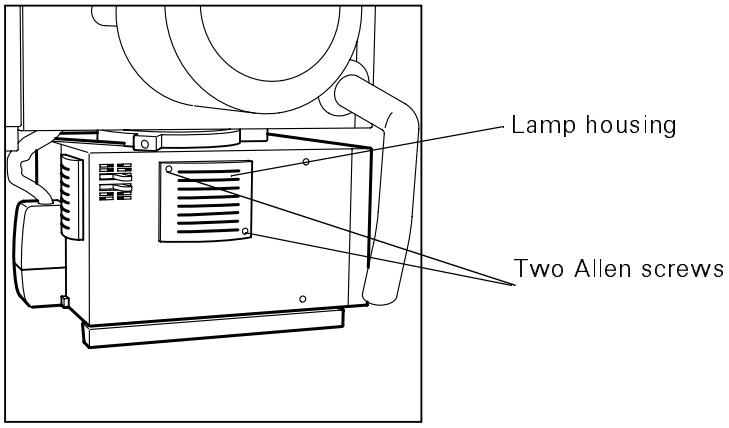
Right Fig.: 0.0 mm Cu prefiltration set (example)

The prefiltration in the multileaf collimator can be set using the two prefiltration levers located on the left side of the collimator.

- The prefiltration levers can be set to the following positions
  - Both levers to the right:
    0,0 mm Cu prefiltration
  - Upper lever to the left and lower lever to the right:
    0,1 mm Cu prefiltration
  - Upper lever to the right and lower lever to the left:
    0,2 mm Cu prefiltration
  - Both levers to the left:
    0,3 mm Cu prefiltration

Changing lamps on the multileaf collimator

❑ The lamp of the multileaf collimator may also be changed by the user if occasion demands.



Left side of multileaf collimator

- ◆ Undo both Allen screws on lamp housing.
- ◆ Remove lamp housing.
- ◆ Undo the two Allen contact screws on the lamp.
- ◆ Replace defective lamp.

❑ Do not touch new lamp with your bare fingers.

- ◆ Screw the two Allen contact screws tight.
- ◆ Mount lamp housing and fasten it by retightening both screws.

Warning

If the halogen lamp of the light localizer remains illuminated for a longer period of time, the housing may heat up.
Please avoid touching the lamp housing to prevent burns.

Warning

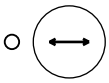
Always use OEM replacement lamps for the light localizer. Halogen lamps which are not short-circuit-proof may break and result in injuries caused by broken glass.

Column movements

The electromagnetic brakes remain released as long as the buttons on the control panel are pressed.

The brakes also lock the overtable x-ray tube unit in case of a power failure.

❏ Used to set film-focus distance from patient positioning table

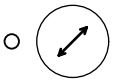


❏ Used to set longitudinal tube unit travel (parallel to patient positioning table) or

❏ Film-focus distance from Bucky wall stand
- LED lights up green if 3D column is located in a lock-in position on its longitudinal track.

❏ Used to rotate tube unit on Bucky wall stand around horizontal axis (90°) or

❏ Set it to oblique position for oblique exposures (0° and ± 90° lock-in positions)



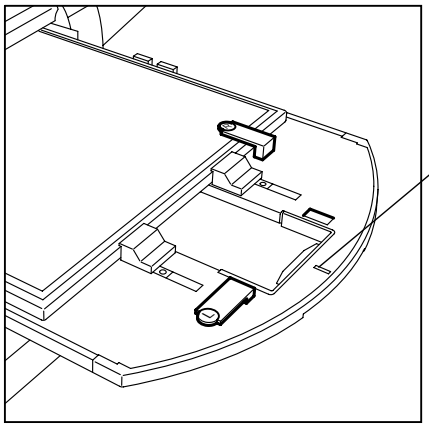
❏ Used for transverse tube travel (across patient positioning table)
- LED lights up green if 3D column is located in a lock-in position on its transverse track.

❏ Used for floating x-ray tube unit travel: i.e. vertical, horizontal and transverse

❏ Used to rotate tube unit around vertical axis

Bring stand to exposure position

- Bring the stand to the preset exposure position using the handles.
  - First release the appropriate brakes.
  - Make sure the stand engages in the transverse and longitudinal rails.



- Switch on the light localizer/linear light localizer on the multileaf collimator.
- With the linear light localizer on the multileaf collimator, center the axis marking (1) on the cassette tray about the middle position.
- Read off the SID with the tape measure or on the three-digit digital "SID" display of the control panel. Release the brakes and use the handles to adjust the tube assembly correspondingly.

The tape measure has a cm and an inch scale

Read off the SID against the bottom edge of the multileaf collimator.

- Use the knobs to set the format height and width with the aid of the format scales on the multileaf collimator and collimate as close as possible to the object.

Collimation close to the object reduces the scattered radiation and thus improves the image quality.

This also reduces the radiation exposure of the patient.

Accessories for the collimator

Three-field templates

Use Exposing the IONTOMAT ionization chambers on the object to be exposed

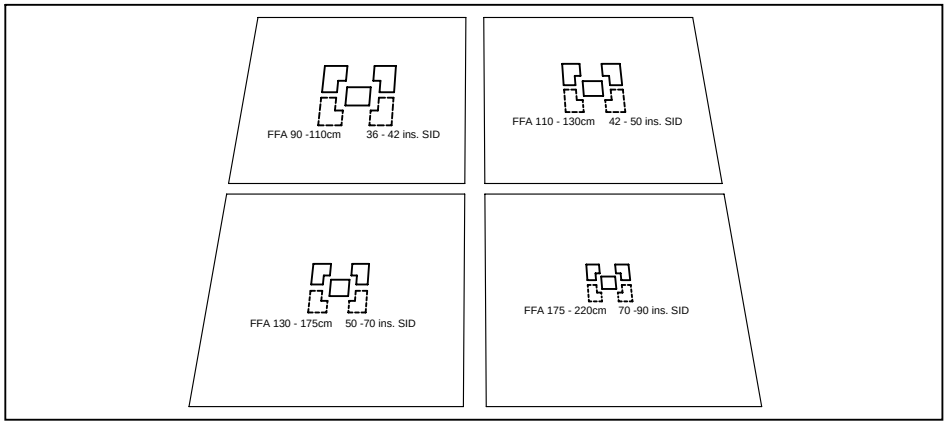
The three-field templates are available as a complete set or else individually for the following SID:

SID: 90 cm - 110 cm

SID: 110cm - 130cm

SID: 130cm - 175cm

SID: 175cm - 220cm



Using the three-field template

- ◆ Press the locking lever on the left accessory rail of the collimator to the left
- ◆ Push the template into the accessory rails of the collimator in the correct direction for exposing the ionization chamber
  - – see label on the catapult Bucky cabinet
- ❑ The locking lever on the accessory rail springs to the right
- ◆ Check the firm location of the template in the collimator
- ◆ Expose the ionization chambers, switch on the light of the collimator for this.

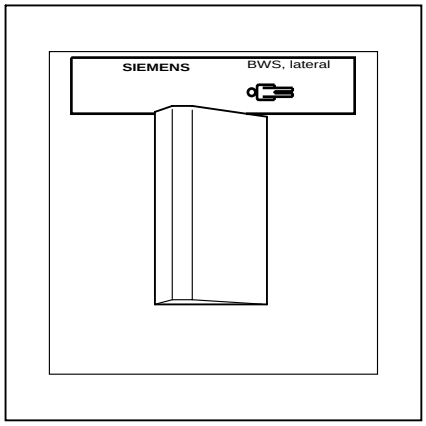
Keeping the three-field templates

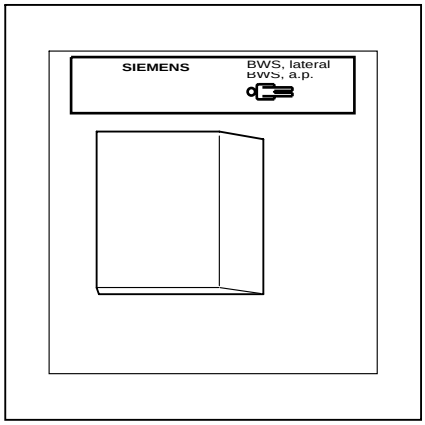
- ◆ Press the locking lever on the left accessory rail to the left
- ◆ Pull the template out from the accessory rails
- ❑ The locking lever on the accessory rail springs to the right
- ◆ Store the three-field templates at a suitable place

Compensating filters / additional filters (optional)

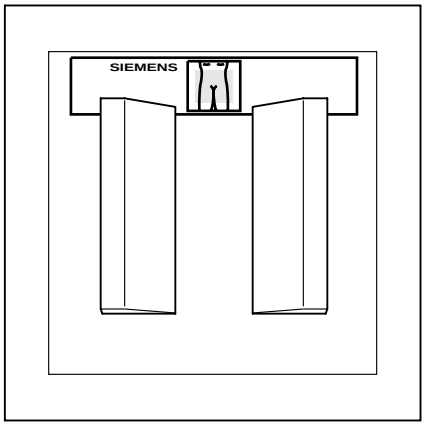
Use Absorption compensation in exposures of

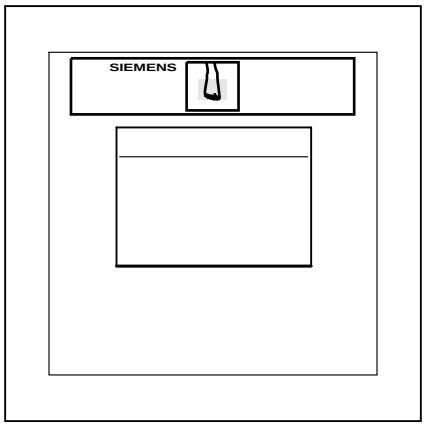
- ❑ Thoracic spine and lumbar spine
- ❑ Pelvis
- ❑ Leg
- ❑ Infant skull
- ❑ Skull
- ❑ Shoulder



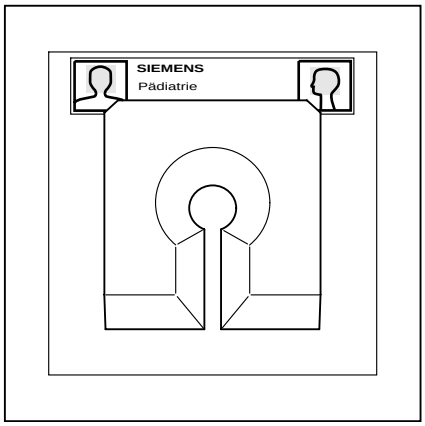


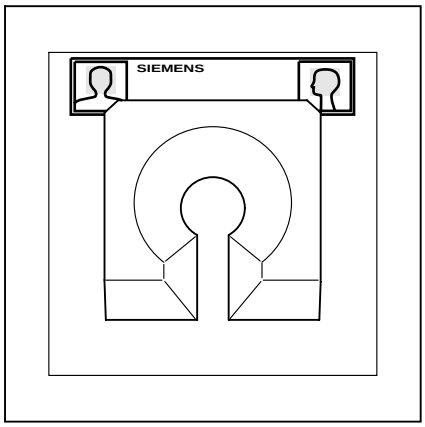
left: thoracic spine, lat.; right: thoracic/lumbar spine, lat.



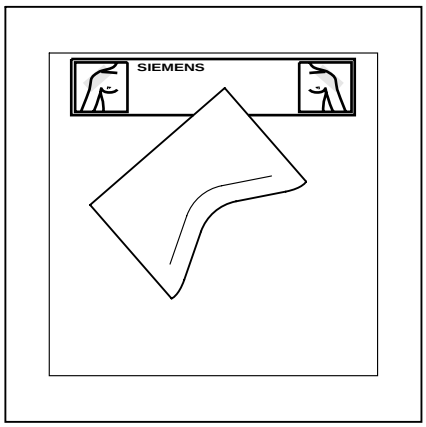


left: pelvis; right: leg





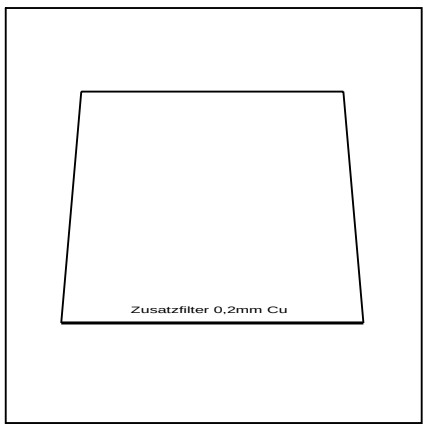
left: infant skull; right: skull



Shoulder

Exposures with beam hardening

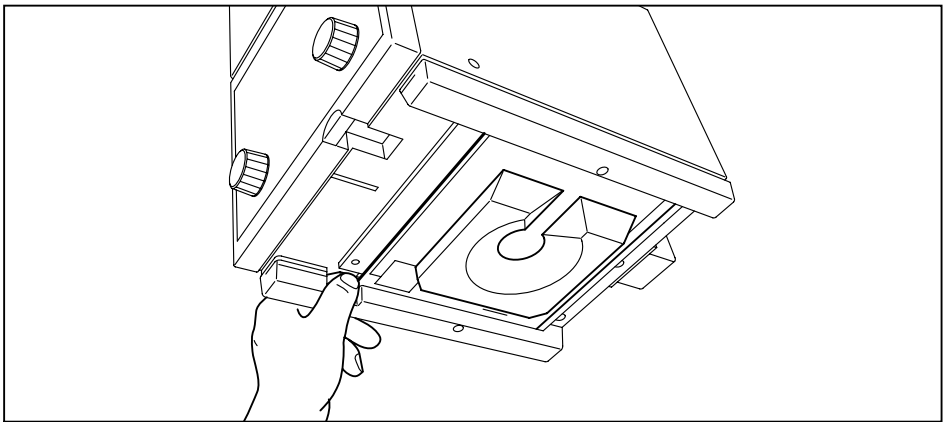
❑ Additional filter 0.2 mm Cu (not transparent)



Additional filter 0.2 mm Cu

Attaching

- ◆ Press the locking lever on the left accessory rail to the left
- ◆ Push the filter up to the stop in the two accessory rails of the collimator



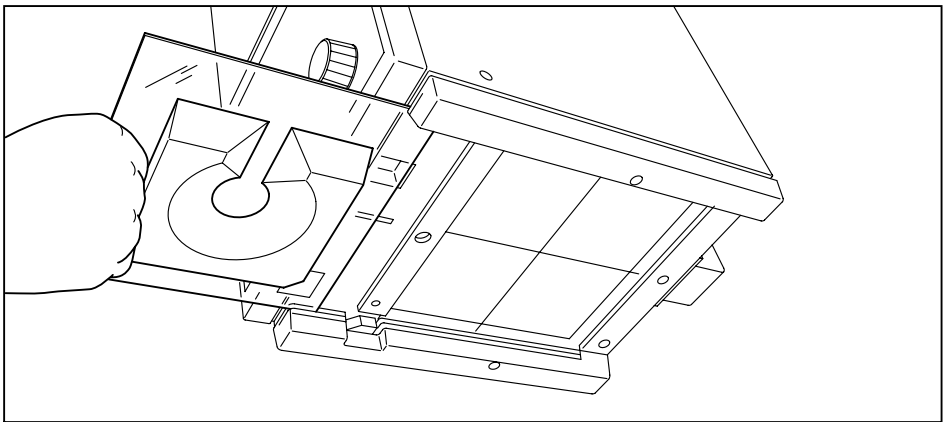
- ❑ The locking lever in the left rail then springs to the right
- ◆ Check the firm location of the filter by pulling and pushing

Warning

If you use accessories from non-Siemens manufacturers, please observe the following: The permissible total weight of the accessory must not exceed 70 N (7 kp).
Exert no torque on the collimator or its rails when inserting the accessory. If the pressure is too high, the rails could be damaged and no longer guarantee safe location of the accessory.

Detaching

◆ Push the locking lever on the left accessory rail to the left



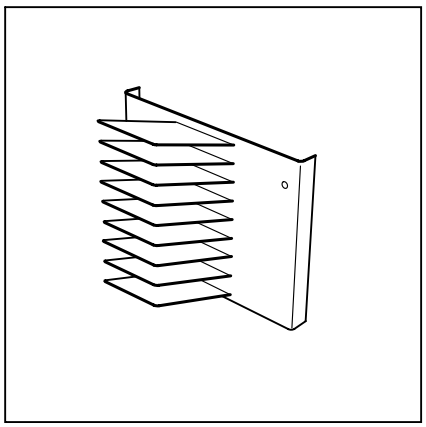
◆ Pull the filter out from the accessory rails of the collimator

❑ The locking lever in the left rail then springs to the right

◆ Store the filter in the holding device

Please handle the compensating filters and three-field templates especially carefully. They are thin, sensitive to scratching and can become useless if roughly handled.

Holding device for eight filters (Option)



Use

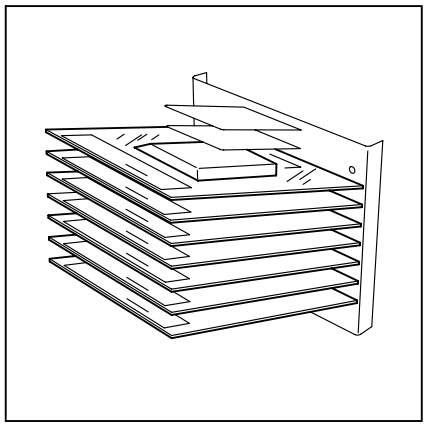
For storing a maximum of eight compensating filters

Fasten the wall holder

- Have the holder fastened to the wall at working height at a suitable place with the enclosed wall plugs and screws.

Equip wall holder with compensating filters

- Remove compensating filters from the packaging.
- Turn the filter so that you can read the designation on the filters reading normally from above.



- Place the filters in the upwards angled compartments

Using the compensating filter

- ◆ Remove the compensating filter from the wall holder
- ◆ Press the locking lever on the left accessory rail of the collimator to the left
- ◆ Push the filter in the direction which is correct for the examination into the accessory rails of the collimator
- ❑ The locking lever on the accessory rail springs back to the right
- ◆ Check the firm location of the compensating filter in the collimator

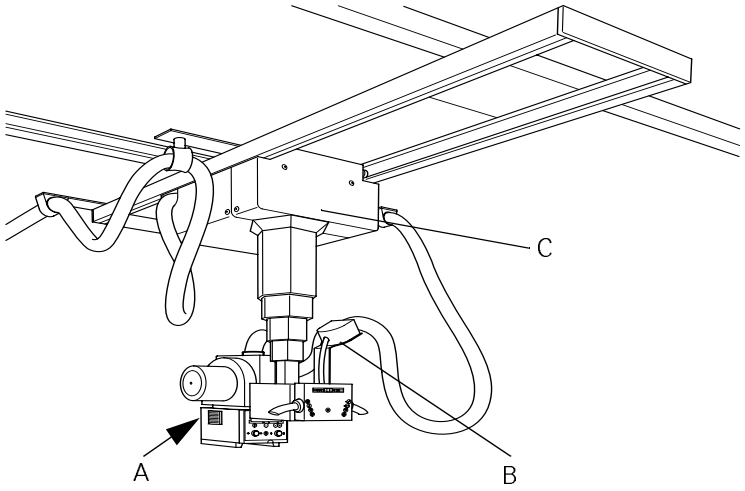
Storing the compensating filter in the wall holder

- ◆ Press the locking lever on the left accessory rail to the left
- ❑ The locking lever on the accessory rail springs back to the right
- ◆ Place the filter in a free compartment of the wall holder, turn the filter so that you can read the designation on the filter reading normally from above

Technical description

Identification labels

The identification labels legally prescribed for these components are located as marked in the layout drawing below.



A Multileaf collimator

B Secondary labels for x-ray tube unit and column

C Column

Technical data

Electrical parameters

Nominal supply voltage	30V-
Nominal a.c.-side current	2.5A

Safety class

Safety class	I
Degree of protection	Type B
Protective system	IP 20

Mechanical parameters

Travel range	longitudinal: 354 cm ± 1 cm transverse: 222 cm ± 1 cm
Vertical travel	150 cm ± 1 cm
Tube unit rotation	around vertical axis: +154°, -182° lock-in positions (click stops) every 90° around horizontal axis: max. ±120° lock-in positions at 0°, ± 90°
Room height	2.81 m ± 1 cm to 3.40 m ± 1 cm
X-ray tube unit	OPTI 150 / 30 / 50 C-100 or Optitop 150 / 40 / 80 HC-100

Multileaf collimator	Manual version with automatic format collimation system and light localizer for rectangular collimation with linear light localizer and rails for secondary filters
Maximum field size	35 cm x 35 cm with a 0.7 m SID 43 cm x 43 cm with a 1.0 m SID
Smallest field size	2.5 cm x 2.5 cm with a 1.0 m SID
Angle of rotation	± 45° around central beam axis
Halogen lamp	Only OEM Siemens lamps may be used as replacement parts! 24 V / 150 W / part no.: 8375545 G2107
Inherent filtration	1.0 mm Al with 75 kV and 2.5 mm total Al filtration
Secondary filters	manual filter selection 0.1 mm Cu; corresponds to 3.5 mm Al equivalent 0.2 mm Cu; corresponds to 7.1 mm Al equivalent 0.3 mm Cu; corresponds to 10.8 mm Al equivalent
Radiation protection	depending on regulations for tube voltages of up to 150 kV
Aperture angle	28° / 28°
DIAMENTOR chamber	Option for installation of a measuring chamber to measure the surface dose product

Section 6

MULTIX TOP Maintenance Instructions

SIEMENS

MULTIX TOP

AX

Also applicable for VERTIX Solitaire

Maintenance

Maintenance Instructions

The Maintenance Protocol
RXB1-150.105.01.04.02
is required for these Instructions

English
Print No.: RXB1-150.101.01.04.02
Doc. Gen. Date: 08.99
Replaces: RXB1-150.101.01.03.02

Chapter	Page	Revision
all	all	01
all	all	02
all	all	03
all	all	04

Page

1 General Remarks

1.1 Manufacturer's Note

This document was originally written in German.

1.2 Required Documents

- Maintenance Protocol — RXB1-150.101.01...
- Adjustment Instructions — RXB1-150.071.01...
- TI 236 Safety Information — On microfilm and paper
- ARTD Laser Radiation — ARTD-002.731.03.

1.3 Required Aids

NOTICE

All tools, test equipment and aids, with the exception of the "standard installation tool kit ", are listed and specified in ARTD (Part 3).

- Standard installation tool kit
- ESD equipment, Type 8501-3M — 37 02 606 Y3121
- Spacer gauge
- Ground wire test instrument — 44 15 898 RV090
- Torque wrench up to 100 Nm (20-100 Nm) — 44 30 906 RH090
- Torque wrench, 2 - 12 Nm — 34 30 063
- Spring balance, 100 N — 44 29 122 NH029
- Service PC with appropriate software
- Torque wrench attachment — 56 60 852 G6019

1.4 Safety Information

CAUTION

When carrying out the work and tests, the product-specific safety information contained in the documents, as well as the general safety information contained in Register 2 of the TI binder must be observed.

1.4.1 Radiation Safety

CAUTION

Checks or adjustments that must be carried out with radiation switched on are labeled with the radiation warning symbol ☢ While performing the work step labeled in this way, radiation protective clothing must be worn.

1.4.2 Protection Against Laser Radiation

- This system contains a Class 2 laser.
- When working on the laser light localizer, do not look directly into the laser beam. See also ARTD Part 2 "Laser Radiation".

1.5 Remarks Regarding Maintenance

NOTICE

When performing maintenance on the MULTIX TOP, inspection and maintenance of the components (generator, VERTIX, etc.) must also be carried out.

The required documents must be obtained in accordance with the system.

Damaged or worn parts may only be replaced with original parts.

The Maintenance Protocol must be filled out and signed by the maintenance technician. Repair work and work steps which are not listed in the checklists must be listed separately.

1.5.1 Explanation of the Abbreviations in the Maintenance Protocol

Abbreviation	Explanation
SI	Safety inspection
SIE	Electrical safety
SIM	Mechanical safety
PM	Preventive maintenance
PMP	Periodic preventive maintenance
PMA	Maintenance, preventive adjustment
PMF	Preventive check of operating values and functions
Q	System quality, image quality
QIQ	Image quality
QSQ	System quality
SW	Software maintenance
FSE	Field Service Engineer (customer service technician)
KSK-No.	Customer-specific code
IVK	Installed volume component
WE	Maintenance unit

1.5.2 Maximum Torque Values (Table)

Nominal thread diameter	Screw material			Steel per DIN 267				Brass CuZn alloy
	Hardness rating	4.6	4.8	5.8	8.8	10.9	12.9	
M 3		0.5	0.67	0.83	1.3	1.9	2.2	0.62
M 3.5		0.76	1.0	1.3	2.0	2.8	3.4	0.95
M 4		1.1	1.5	1.9	3.0	4.2	5.1	1.4
M 5		2.2	3.0	3.7	6.0	8.4	10.1	2.8
M 6		3.8	5.1	6.4	10.2	14.4	17.3	4.8
M 8		9.5	12.6	15.8	25.3	35.6	42.7	11.9
M 10		18.7	24.8	31.1	49.8	70.0	84.0	23.3
M 12		32.9	43.8	54.8	87.6	123.3	147.9	41.1

When checking tightness, use the corresponding torque values for hardness rating 8.8.

NOTICE **A tolerance of ±10% is admissible for torque values.**

1.5.3 Lubricants

- Klüberplex GE11-680 100ml 55 07 608
- Contact spray 28 70 061 RE008 (as rust protection for rails)
- Viscogen KL 300 73 95 353 RH090 (for steel cables)
- Longtime PD2 20 g 34 91 271; 1 kg 73 95 449

1.5.4 Cleaning

Soiling that is not accessible to the customer's cleaning personnel must be removed using a concentrated cleaning liquid during maintenance work.

Soften contrast medium with water and remove.

After completing the maintenance work, remove coarse soiling on painted parts only with alcohol or a concentrated cleaning liquid.

- Hakapur 96 60 648 RH999
- Alcohol

1.5.5 Paint Colors

- White (textured) 4146
- White (spray can) 84 27 734 RE999
- White (paint stick) 34 44 403

1.5.6 Abbreviations Used in these Maintenance Instructions

FFA = Film-focus distance (SID)
ISK = Allen screw
RWG = Bucky wall stand
TB = collimator
DVM = Digital voltmeter
RL = Bucky
DHA = Rotation around the horizontal axis
DVA = Rotation around the vertical axis
SSW = Service software

1.5.7 Remarks Regarding Working with the Service Software

A help text is available for the individual masks. The help texts contain details about the individual work steps.

Start the help text: Press "F1" key
Exit the help text: Press "Esc" key

1.5.8 MULTIX TOP Wearable Parts

Component	Designation	Quantity	Part No.	Replace every 3 years	Replace if damaged
3D TOP Ceiling stand	Cable, E-TL set	1	30 71 219 G6019		X
	Brake lining	2	30 70 815 G6019		X
Collimator	Pilot lamp	1	83 75 545 G2107		X
Table	Roller bearings	4	04 75 111 G050G		X
	Rubber bumpers, transv.	4	04 73 637 G050G		X
VERTIX PRO	Steel cable	1	12 92 031 GE072	X	
VERTIX TOP	Steel cable	1	12 92 031 GE072	X	
	Steel cable	1	12 92 338 GE072		X
	Connection steel cable	1	12 92 213 GE072		X

1.6 Special Symbols

- Symbol for working with radiation.

- Symbol for working with dangerous voltage.

- Symbol for torque value.

- Symbol for working with laser radiation.

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2 Ceiling Stand

2.1 Longitudinal Carriage

SIM Checking the Condition and Mounting

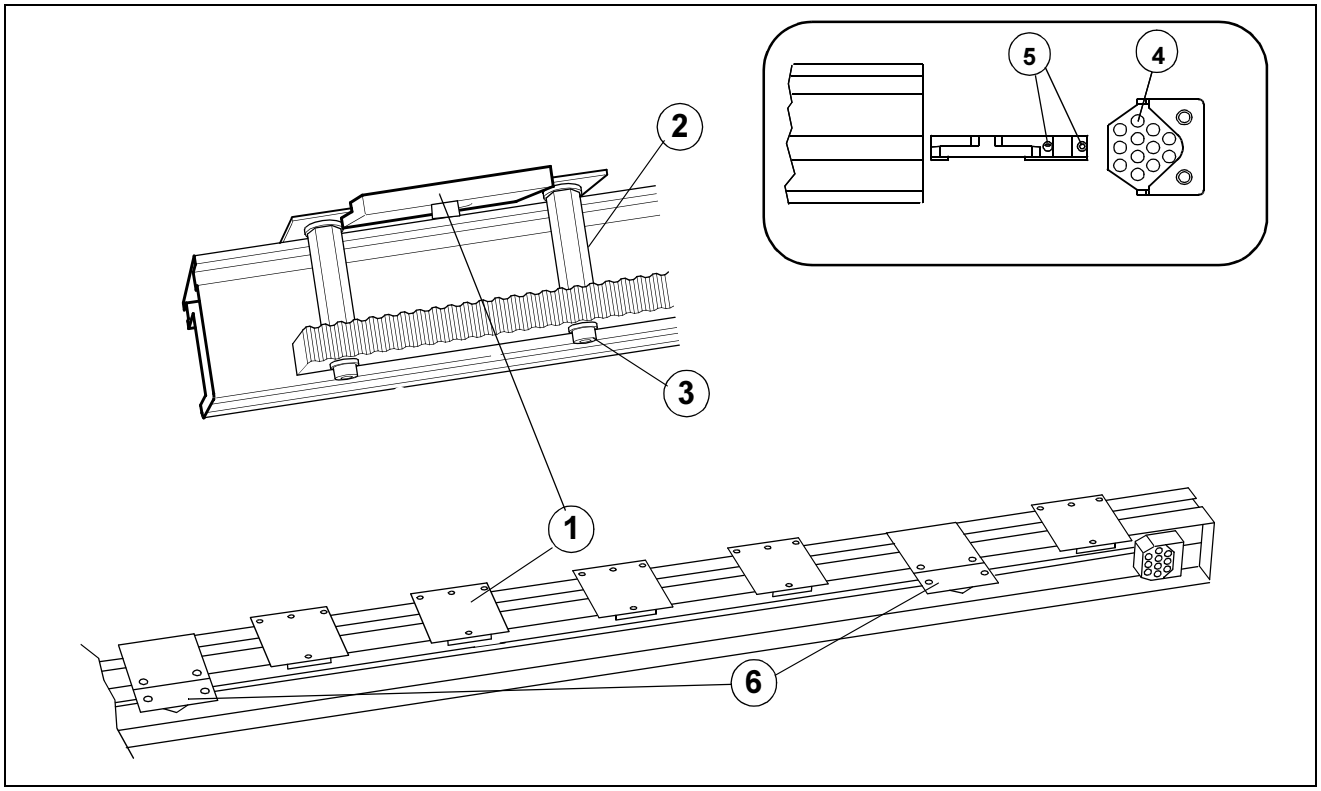

Fig. 1

⚠ Longitudinal rail ceiling mounting (M10 Allen screws): 50 Nm

NOTICE	**For the screws through the pinion rack that are not accessible, it is absolutely necessary to use the "Torque wrench attachment 5660852". Otherwise the screw heads can be damaged.**

- Pinion rack

NOTICE	**The pinion rack mounting should be secured with LOCTITE when first installed. In this instance, NO check is required. As a check, remove one screw to determine whether LOCTITE has been used for securing; then reinsert the screw with LOCTITE. If LOCTITE has not been used for securing the screw, all screws in the pinion rack must be secured with LOCTITE.**

⚠
- Clamp connection of the switch strike plates (6/Fig.1) for the S42/43 safety limit switches (M4 Allen screws): **2 Nm**

⚠
- End stops and rubber bumpers (4/Fig.1)
- M6 set screws (5/Fig.1) for the stop detents, longitudinal (SID), **10 Nm**

PMP Cleaning

- Contact surfaces for roller bearings and lateral guide bearings in the transverse bridge.

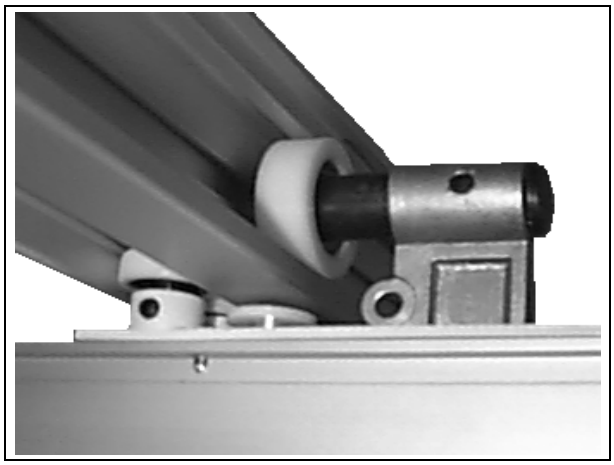

Fig. 2

2.2 M4 Transverse Bridge

SIM Checking the Mounting

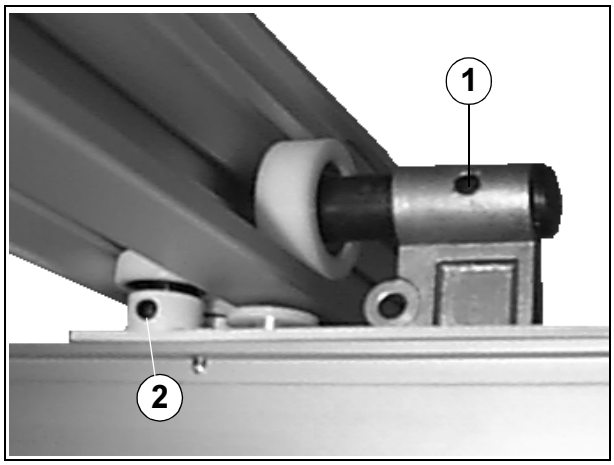

Fig. 3

- Roller bearings, lateral guide bearings (2/Fig.3)

⚠

- M8 set screws (1/Fig.3) to secure the roller bearings, **25 Nm**

SIE Checking the Condition

- Check cable conduits, corrugated hose and cables for damage.

SIM Checking the Mounting

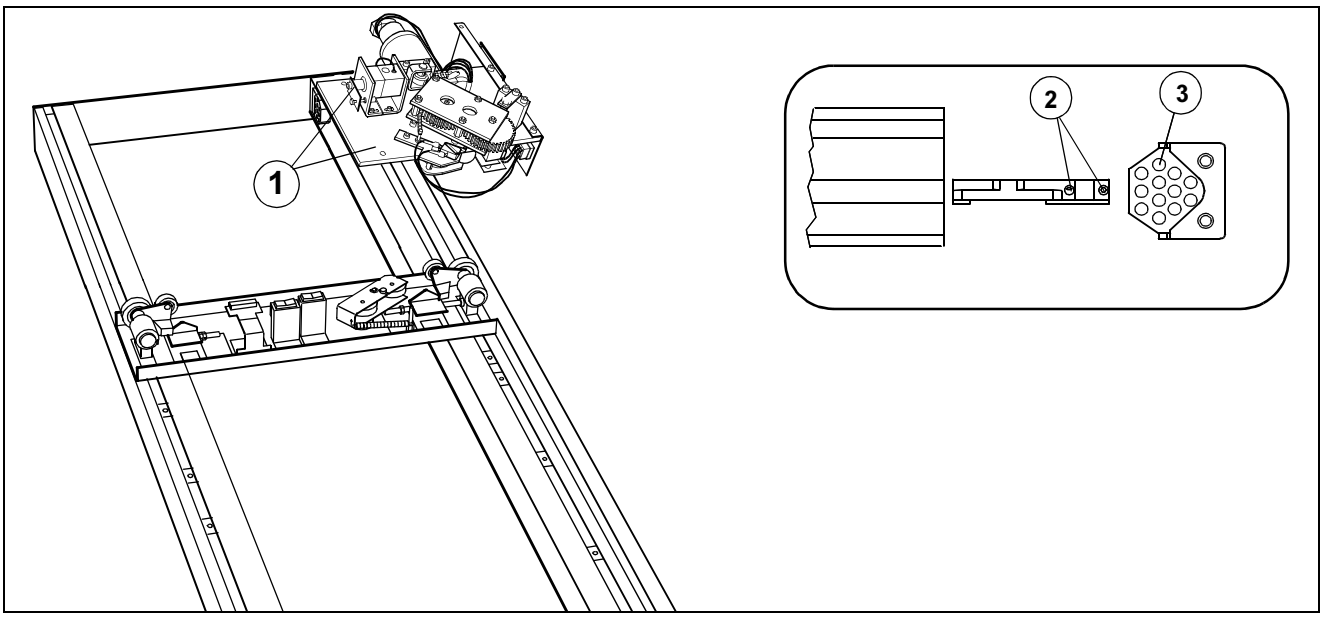

Fig. 4

- Check the mounting points for the cable guides.
- Check the stops and rubber bumpers (3/Fig.4).
- Check the M6 set screws (2/Fig.4) of the SID stop detents, transverse, **10 Nm**.
- Check the mounting screws for the tomo drive (two M8 Allen screws), **25 Nm**.
- Check the cover panels on the tomo drive.
- Check any optional parts.

PMP Cleaning

- Roller bearings
- Lateral guide bearings
- Contact surfaces

PMA Brake Assembly, Brake Lining

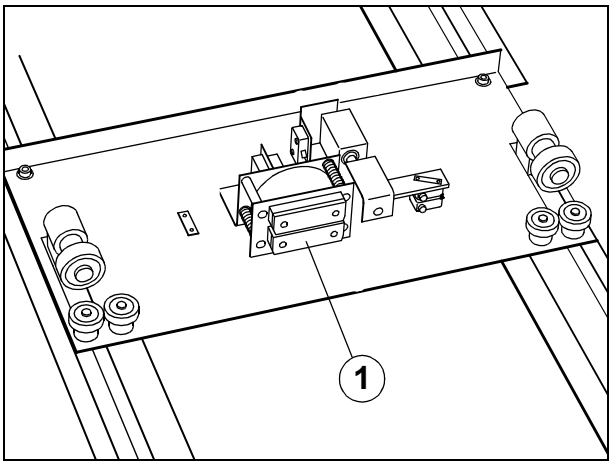

Fig. 5

- Check the condition of the brake linings (1/Fig.5).
- Check to assure the braking and movement forces per the Adjustment Instructions are maintained.
- No friction may be detected when the transverse bridge is moved.

2.2.1 S42/S43 Safety Limit Switches (Tomo)

SIE Checking the Function of the Safety Limit Switches

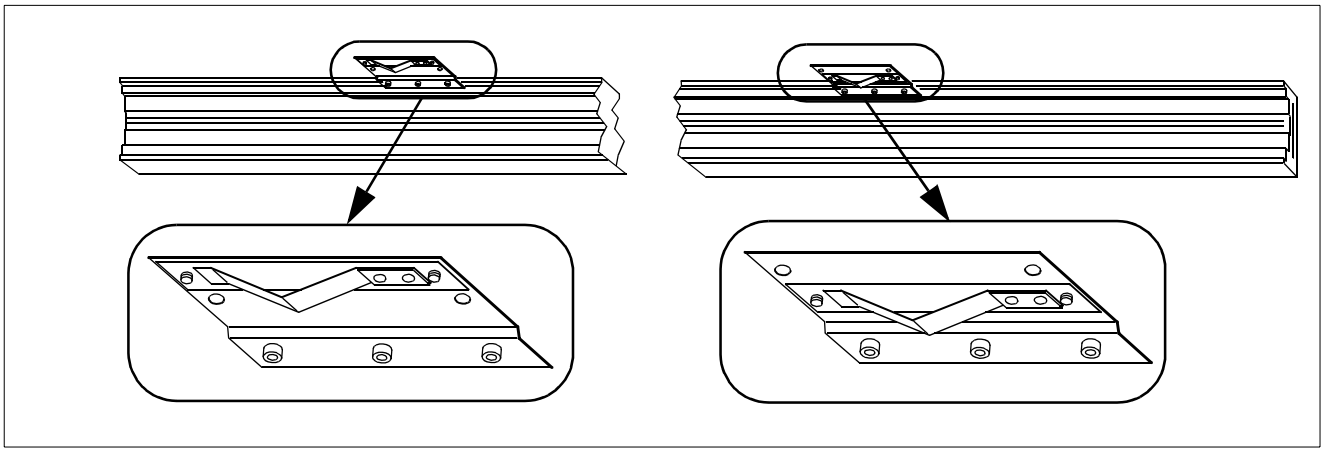

Fig. 6

- Select the tomo mode.
- Move up to each limit switch. The switches must be positively actuated, the safety breaker must deenergize and the red lamp on the left side of the table (safety circuit) must go on.

2.2.2 Tomo Drive

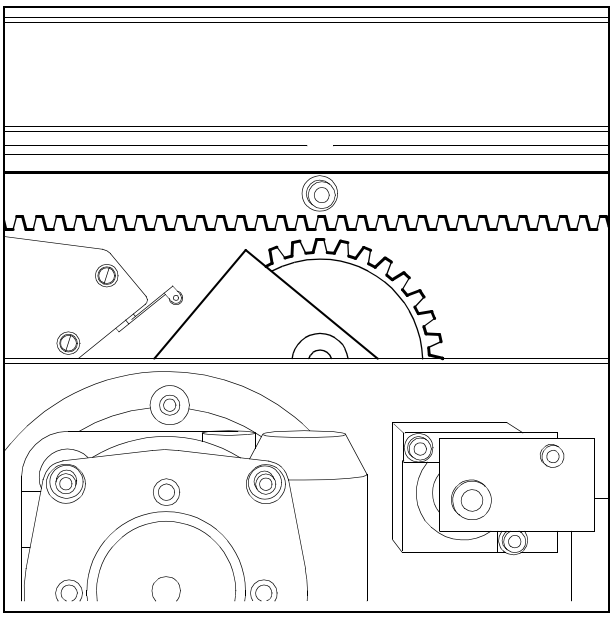

Fig. 7

- Check the spacing between the pinion gear and rack (per the Adjustment Instructions).
- Check the function of the lift magnets.
- Check for maintenance of the longitudinal braking and movement forces per the Adjustment Instructions.

2.3 M1 Telescope Carriage

SIE Checking the Condition of the Corrugated Hose and Cables

- Check for good condition.

SIM Checking the Mounting

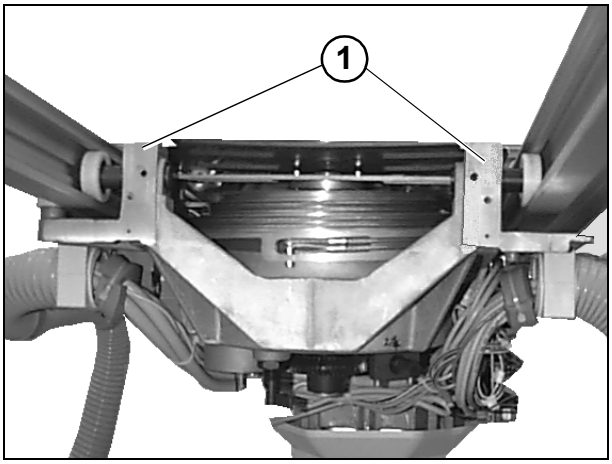

Fig. 8

- Check the mounting points for the cables guides.
- Check the roller bearings, lateral guide bearings.
- Check the set screws to secure the roller bearings (1/Fig.8), **13 Nm**.

⚠

- Check the cover panels.
- Check any optional parts.

PMP Cleaning

- Roller bearings
- Lateral guide bearings
- Contact surfaces

2.3.1 Brake Assembly, Brake Lining

PMA Checking the Condition of the Brake Lining and Mounting

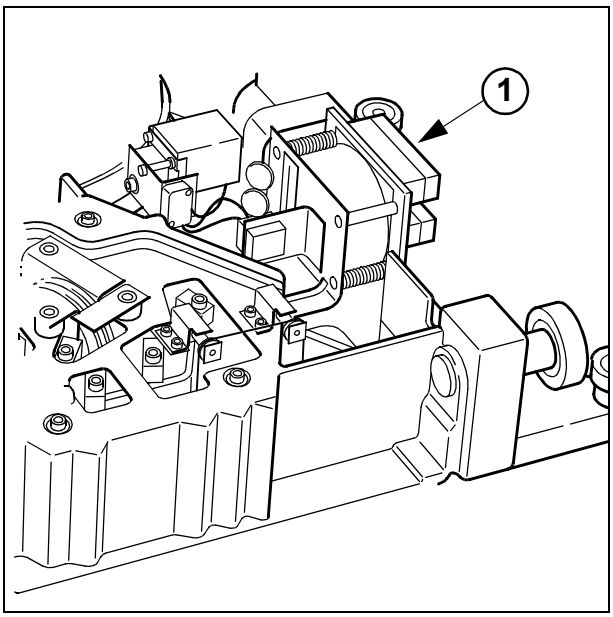

Fig. 9

- Check the adjustment (1/Fig. 9).
- Check for maintenance of the braking and movement forces per the Adjustment Instructions.
- No friction may be detected when the transverse bridge is moved.

2.3.2 Y13 Lift Brake

PMF Checking the Function of the Lift Magnets

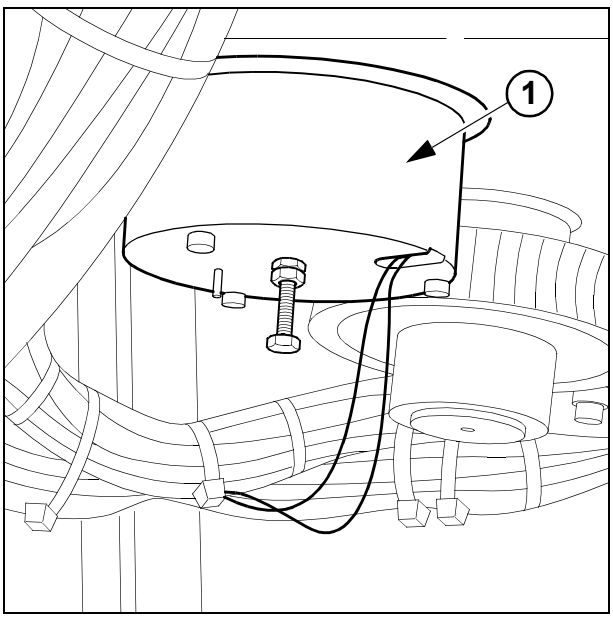

Fig. 10

- Brake (1/Fig. 10) must release when the ↕ key is pressed and when the key is released, it must audibly engage.

2.3.3 Spring Tension of the Weight Compensation

SIM Checking the Weight Compensation

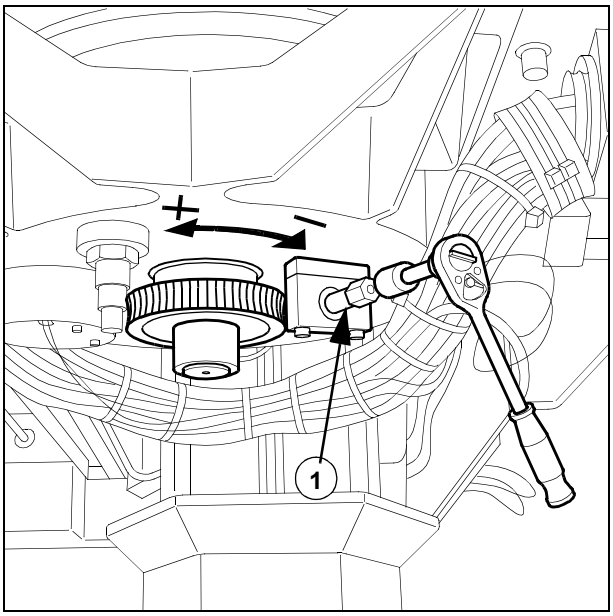

Fig. 11

The stand must be adjusted so that it is slightly buoyant (range: 0.3-1 kg or per the customer's request). Readjust the weight compensation using a 17 mm attachment on the wrench at the adjustment screw (1/Fig. 11) on the telescope. When doing so, take note of the arrow on the cast metal housing for the spring mechanism and of the +/- rotation direction of the pinion gear.

NOTICE **If the tension spring is expanded frequently in a brief time period and/or if a reduction of the maximum expansion length is determined, replace the tension spring.**

CAUTION **When replacing the spring mechanism, the spring housing may not be opened; risk of injury!**

2.3.4 Condition of the Support and Safety Steel Cables

SIM Checking the Steel Cables for Broken Strands (periodic, every 12 months)

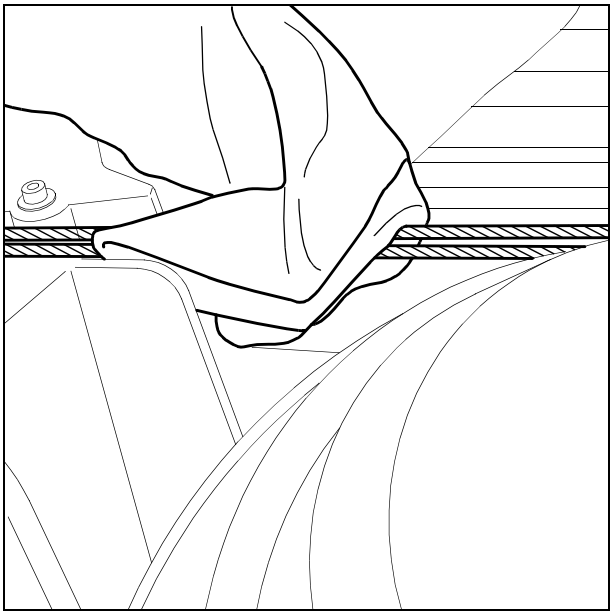

Fig. 12

- To do this, let the steel cables run through a cleaning cloth as shown Fig. 12, broken strands and cable damage are indicated by any caught fibers.
- Relubricate the steel cables with VISCOGEN KL300.

NOTICE	**If broken strands are found, always replace both steel cables.**

- Check for maintenance of the braking and movement forces in the transverse and vertical directions per the Adjustment Instructions.

2.4 M3 Support Arm

PMA Rotation Movements

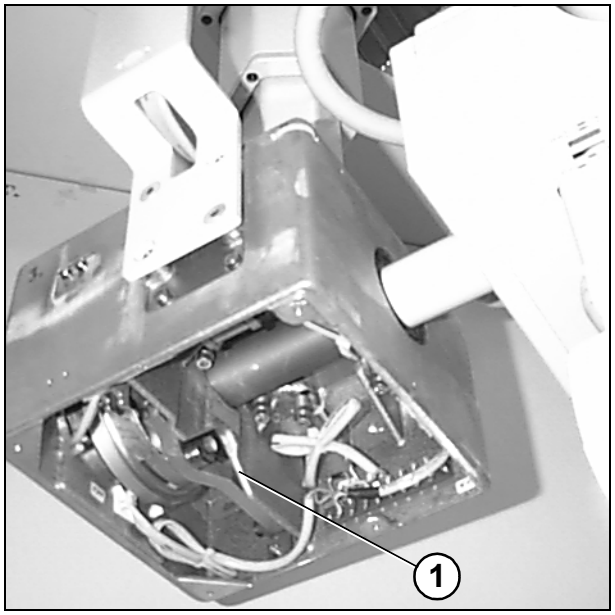

Fig. 13

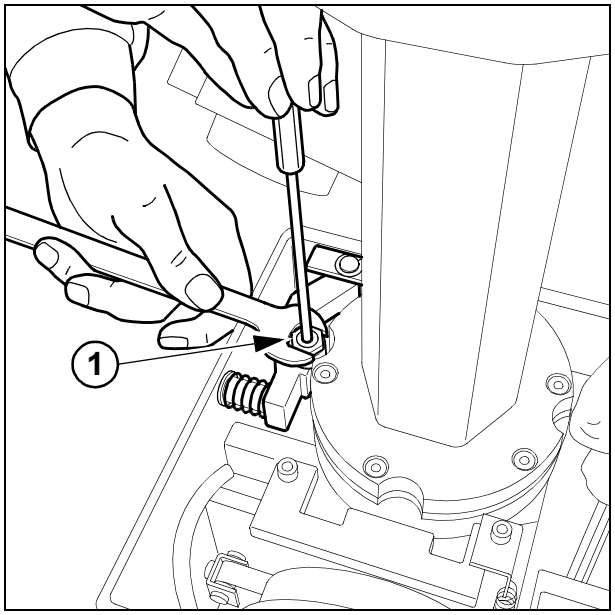

Fig. 14

- Check rotation around the horizontal axis (DHA) (1/Fig.13)
- Check the stop positions and check the alignment of the central beam to the table and to the VERTIX per the Adjustment Instructions.
- Check rotation around the vertical axis (DVA) (1/Fig.14).
- Check the stop positions and the alignment of the central beam to the table and to the VERTIX per the Adjustment Instructions.

SIM Mounting on the Telescope

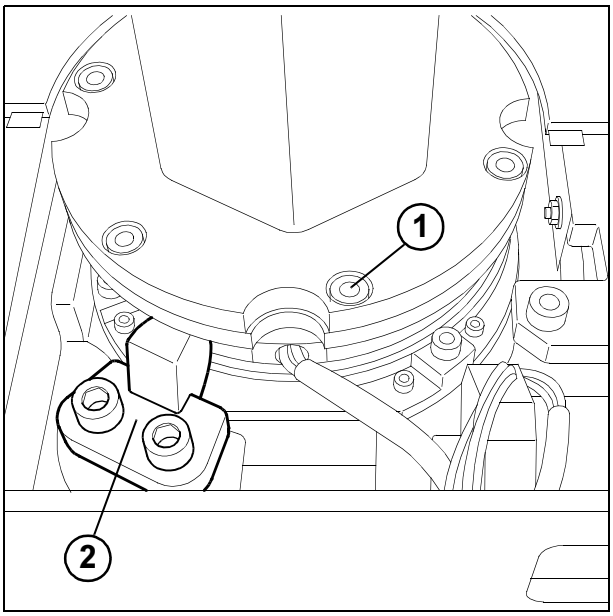

Fig. 15

⚠

- Check the condition and mounting (six M6 Allen screws) of the support arm (1/Fig. 15), **10 Nm**.
- Check the condition of the end stop (2/Fig.15) for wear and its mounting.

SIM Play in the Support Arm (DHA)

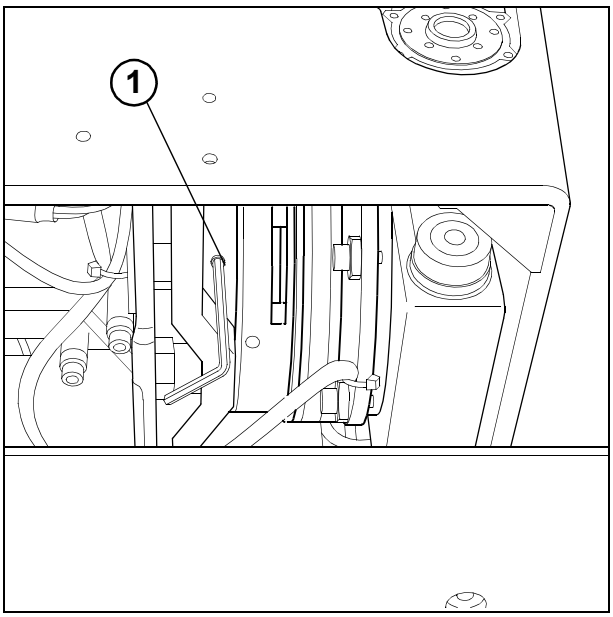

Fig. 16

- Check the 3 mounting screws (1/Fig.16) to make sure they are tight on the rotation axis.

2.5 Z66 Collimator

SIM Adjusting the Rotation Flange

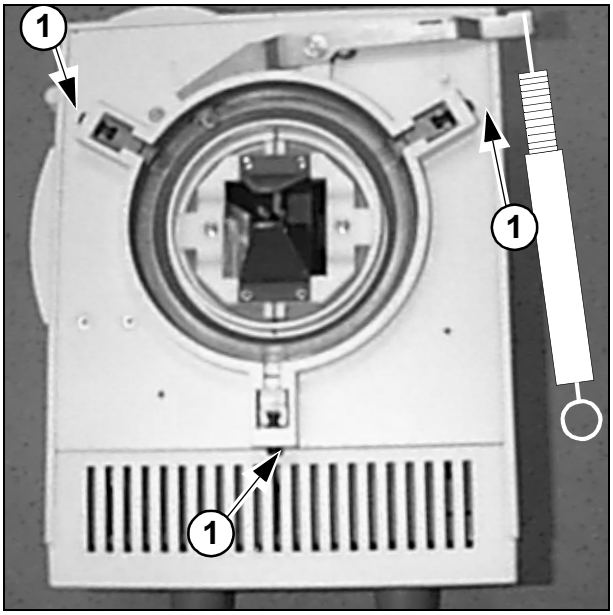

Fig. 17

- Check the adjustment of the rotation flange function.
- Check for easy rotation movement. The force on the spring balance as shown in Fig.17 must be 60 - 70 N (see Adjustment Instructions).
- If needed, remove the collimator, clean the flange and collimator ring and relubricate with PD2 Longtime.
- Adjust the tightness of the mounting screws (1/Fig. 17) per the Adjustment Instructions.

5 Emergency Off

5.1 Emergency Off Switch

NOTICE	**An emergency off switch must be installed on every system.** **Power can be switched off from the power source to the entire system by means of the emergency off switch.**

SIE Checking the Function

- When the system breaker is switched off, power is switched off from the power source to the entire system.

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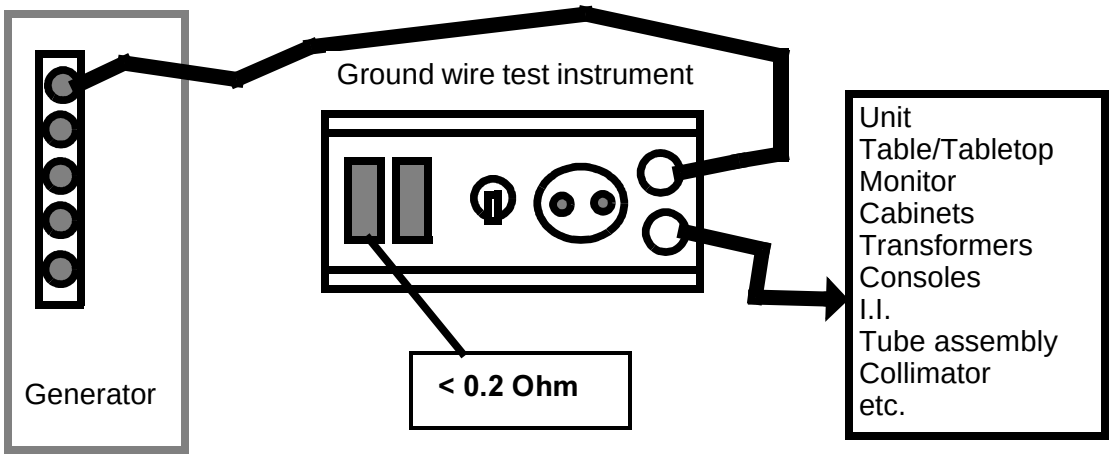
6 Ground Wire Measurement

SIE Checking Ground Wire Resistance



Test instrument:	Ground wire test meter	
Measurement value:	max. 0.2 Ohm	(observe country-specific regulations)
		(current: 10 A, voltage drop: max. 2 V)
Test procedure:	Measure between all conductible parts of the system that can be touched and the ground wire rail in the generator.	
Conditions:	Ground wire resistance, max. 0.2 Ohm • If greater, increase the ground wire cross section • Lower transfer resistance (e.g. tighten screws)	

Final work steps

- Reinstall all cover panels.

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7 Image Quality

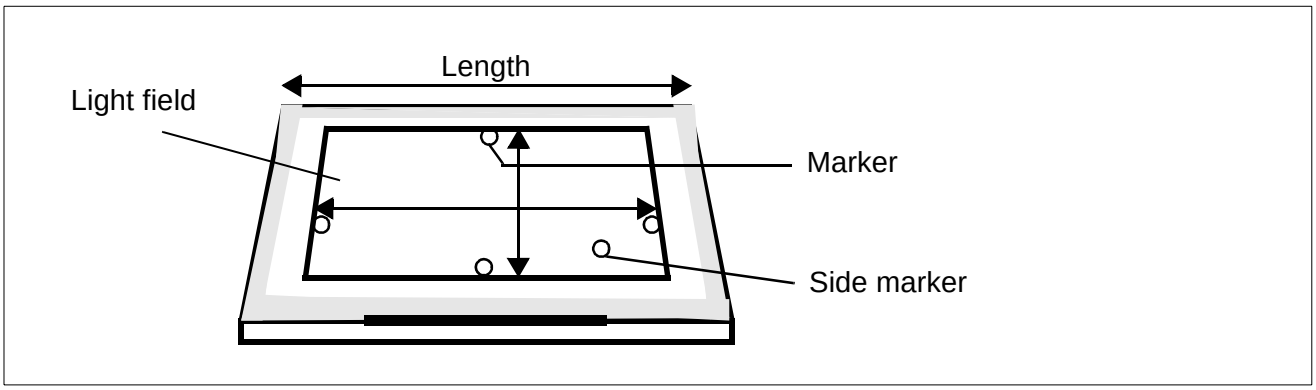


Fig. 1

QIQ Check of the Light Field, Radiation Field and Format Collimation

- Position the central beam so it is vertical.
- Place a 20 cm x 30 cm (10”x12”) cassette on the MULTIX TOP tabletop.
- Set a vertical SID of 115 cm.
  - Use the tape measure in the collimator to measure to the top surface o the cassette.
- Use the knobs on the collimator to **exact** set a display of 18 cm x 24 cm or 8” x 10” (the exposure is also used for the check of the manual format collimation).
- Switch on the light localizer.
- Place a radio-opaque marker (e.g. washer, coin) on the cassette as shown in Fig. 1.
- Place on a washer as a side marker.
- Trigger an exposure: (; 50 kV; 5 mAs) and develop the film.
- Use a waterproof felt pen to make a note of the following data on the developed film:
  - Set SID
  - Focus size
  - Film size
  - Radiation field size

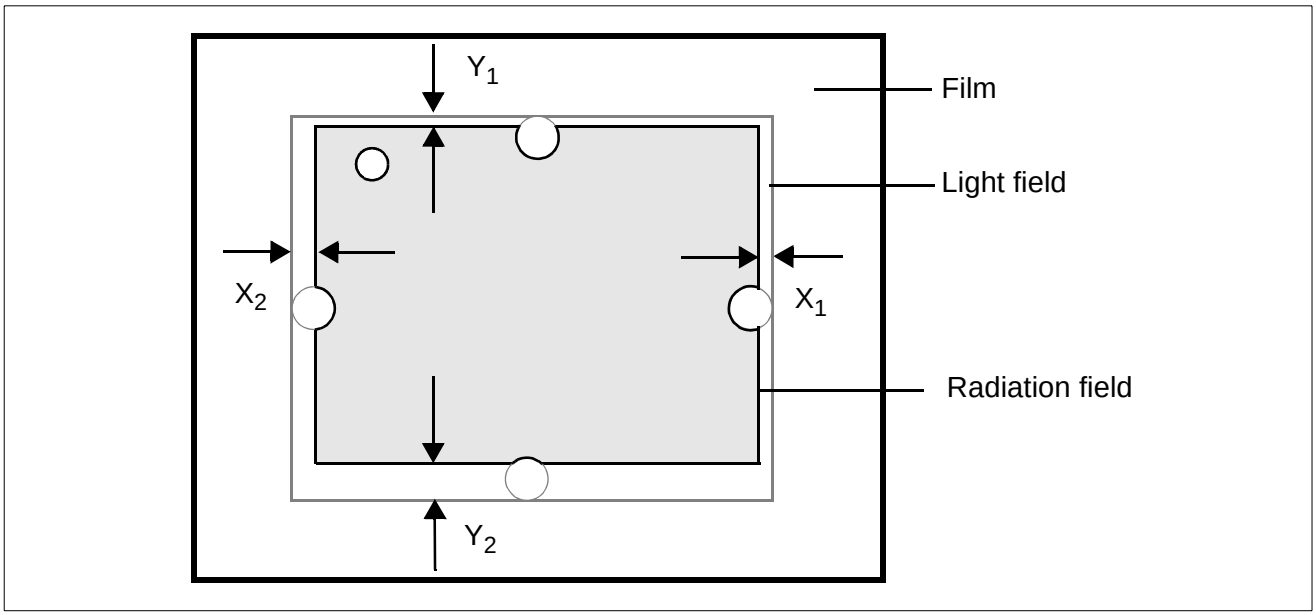


Fig. 2

Evaluation: Coincidence of Light Field to Radiation Field

- Calculate the total difference in the X and Y directions (without regard to the mathematical sign in front).
  - The difference in width Σ X and the difference in length Σ Y may not exceed 1.4 cm at an SID of 115 cm.

Evaluation: Manual Format Collimation

- Calculate the difference in length and width between the size of the radiation field and the set format.
  - The difference in both directions (length and width) may each not exceed 1.4 cm.

QIQ Centering (Bucky A = MULTIX Table)

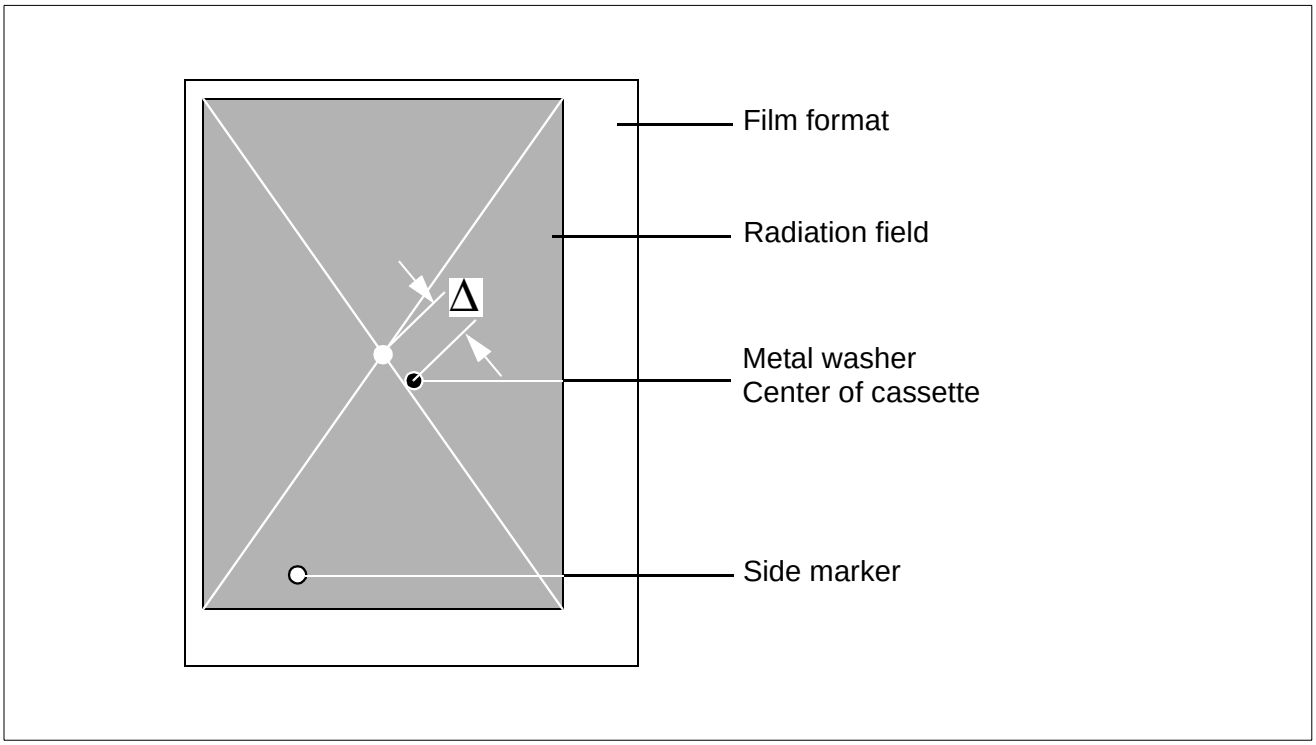


Fig. 3

- Check the coincidence of the radiation field center and film center (Bucky A MULTIX table).

Procedure:

- Position the central beam so it is vertical, center the tube assembly over the cassette tray marker and set an SID of 115 cm.
- Move the tube assembly in the transverse direction into the middle position stop.
- Mark the 24 cm x 30 cm (10”x12”) cassette with a center marker (tape on a metal washer) and place on a second marker as a side marker (Fig. 3).
- Load the marked cassette with film, insert it into the cassette tray and slide the tray in all the way to stop.
- Use the knobs on the collimator to set a format of 18 cm x 24 cm (8” x 10”) per the scale (SID = 115 cm).
- Trigger an exposure (■; 50 kV; 5 mAs) and develop the film.

Evaluation:

- Evaluate the center deviation Δ as shown in Fig. 3.
  - The difference may not exceed 17 mm at an SID of 115 cm.

QIQ Centering (VERTIX PRO/TOP)´

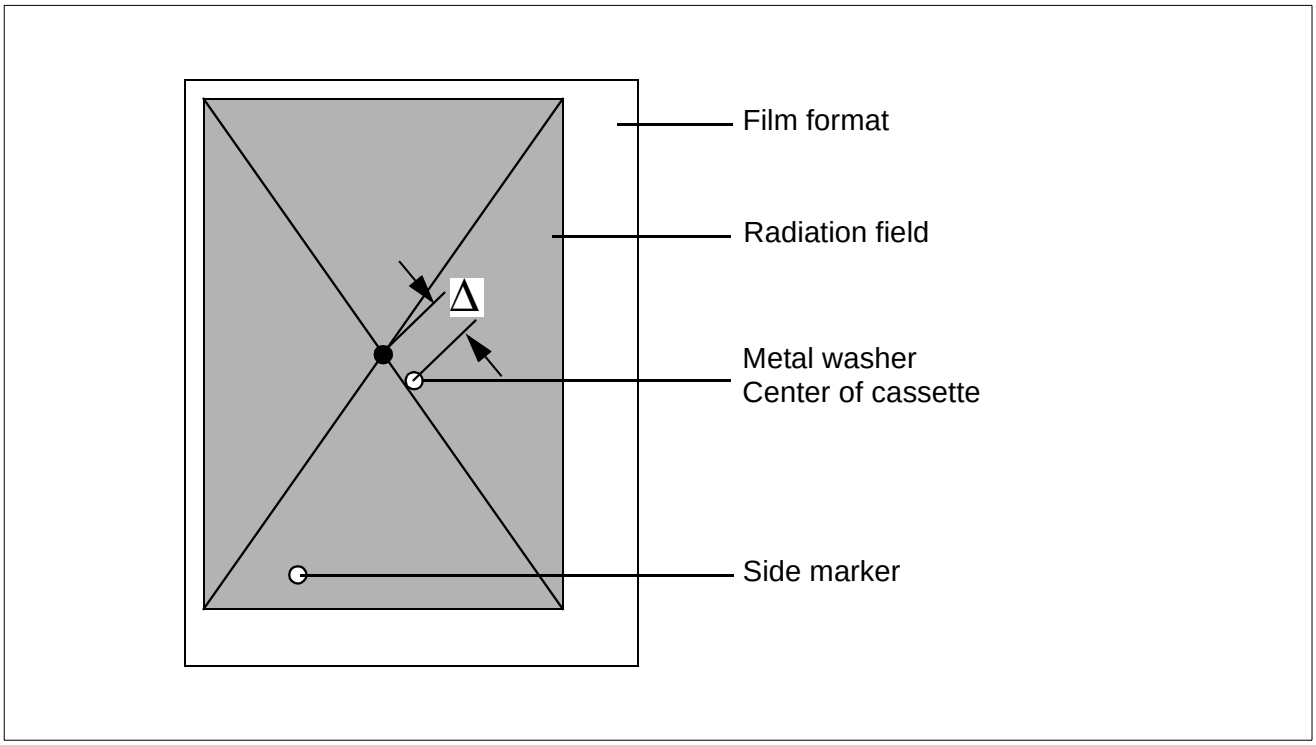


Fig. 4

- Check the coincidence of the radiation field and film center to the VERTIX PRO/TOP (if configured)

a) Horizontal beam direction

Preparation:

- With a 24 cm x 30 cm or 10” x 12” cassette, mark the center of the cassette by taping on a washer and place on a second washer as a side marker.

Procedure:

- At the generator, select the workstation for the VERTIX.
- Pivot the tube assembly into the horizontal beam direction.
- Move the tube assembly in the transverse direction into the middle stop to the VERTIX.
- Set the min. SID.
- Insert a 24 cm x 30 cm or 10” x 12” cassette with a center marker into the cassette tray and slide the tray all the way in to stop.
- Center the line light localizer to the center marker of the cassette tray.
- Use the knobs on the collimator to set a format of 18 cm x 24 cm or 8” x 10”.
- Trigger an exposure (■; 50 kV; 4 mAs).

- Develop the film, determine the center of the radiation field and evaluate the film per Fig.4.

The max. center deviation Δ may **not** exceed the following values:

SID	**max. Difference** (corresponds to 1.0% of the SID)
1.00 m	1.00 cm
1.15 m	1.15 cm
1.50 m	1.50 cm
2.00 m	2.00 cm
3.00 m	3.00 cm
36”	0.91 cm
40”	1.01 cm
48”	1.21 cm
72”	1.82 cm

b) Vertical beam direction (only with VERTIX TOP)

Preparation:

- Mark the center of the cassette with a 24 cm x 30 cm or 10”x12” cassette by taping on a washer and place on a second washer as a side marker.

Procedure:

- Pivot the tube assembly into the vertical beam direction.
- Pivot the table out to face the Bucky wall stand.
- Center the tube assembly to the catapult Bucky (move into the stop detents in the long. and transverse directions).
- Set the SID to 115 cm or 40”.
- Insert a 24 cm x 30 cm or 10”x12” cassette with the center marker into the cassette tray and slide the tray all the way in to stop.
- Use the knobs on the collimator to set a format of 18 cm x 24 cm or 8”x10”.

- Trigger an exposure (■; 50KV; 4mAs).
- Develop the film, determine the center of the radiation field and evaluate the film as indicated in Fig. 4.

The max. center deviation Δ may **not** exceed the following values.

SID	**max. Difference (corresponds to 1.0% of SID)**
1.15 m	1.15 cm
40”	1.01cm

QIQ Accuracy of Automatic Formating for Cassette Formats

NOTICE

Check the collimation accuracy with automatic formating with 3 formats for each Bucky and document the results. Check the 3 formats by generating a test film.

Bucky A, MULTIX Table

- Select the MULTIX.
- Move the tube assembly in the transverse direction into the middle position, set SID = 115 cm.
- Center the line light localizer on the centering mark of the cassette tray.
- Place a 35 cm x 43 cm or 14” x 17” cassette with film so it is centered to the light localizer on the tabletop.
- If possible, use the three formats 13 cm x18 cm (5” x 7”), 18 cm x 24 cm (8” x 10”) and 24 cm x 30 cm (10” x 12”) for the test. If fewer formats are used at this workstation, check only those.
- At the generator, select (■, approx. 40 kV, 5 mAs (with the universal screen).
  The exposure should produce a density of about 0.7 over base fog.
- Then, one after the other, beginning with the smallest format, insert three cassettes without film into the catapult Bucky, allow it to format automatically, and trigger an exposure for each.
- After inserting the cassettes into the catapult Bucky, check whether the inserted cassette format is displayed on the collimator.
  The maximum admissible difference between the display and the cassette format is ± 0.3 cm.

Evaluation:

The 3 exposures are made on the 35 cm x 43 cm or 14” x 17” cassette on the tabletop, one on top of the other; evaluation is possible by observing the different density of the individual formats (see Fig. 35).

- Develop the film and label it.

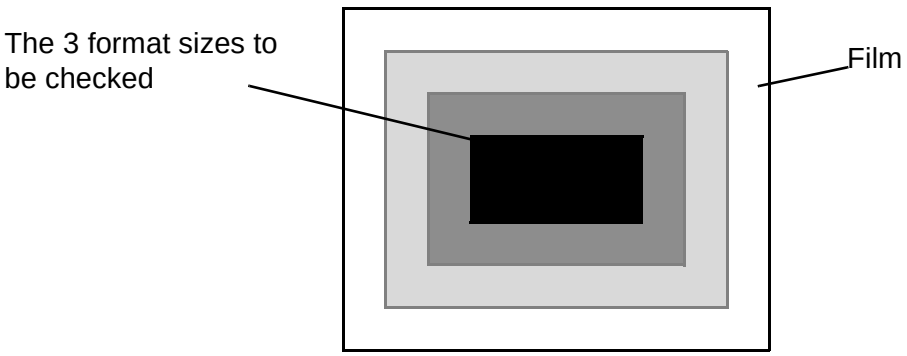


Fig. 5

QIQ Check of the Tomo Exposures

- Select the Bucky mode (key).
- Position the stand in the longitudinal and transverse stops, the corresponding LED next to the key lights up.
- Set the SID to 115 cm or 102 cm.
- Prepare the tomo test block and position it on the tabletop so it is centered to the light localizer. One line test must be positioned on the anode side, the other must be pointing to the tomo height line light localizer (test per the Adjustment Instructions).
- Load a 18 cm x 24 cm (8" x 10") cassette with the high resolution screen ($S \leq 200$) with film and insert it into the catapult Bucky.

- Trigger a Bucky exposure:
  - Exposure data: 81kV, small focus ▣, 80% power, middle measuring field ▪
    1.2 mm Cu filter.
- A basic density of D = 1...1.4 should result. Depending on the screen type, set a different mAs value.

- If necessary, repeat the first exposure with modified exposure data.
- Once more make sure that the notches of the two line tests are at the same height above the tabletop; exactly measure this dimension (115 mm, ±1mm).
- Select the 40^{o}; 2 sec tomo program. The longitudinal brake automatically releases and the catapult Bucky centers itself automatically to the central beam.
- Select the tomo height so that the displayed tomo height exactly matches the measured "notch height".

- Make 2 tomo exposures: 40°; 2 sec. and 20°; 0.6 sec.
  - Exposure data:
    81kV and to achieve the same density for the tomo exposure as for the Bucky exposure, increase the mAs value by one mAs point:
  - Exactly label all exposures:
    81 kV, mAs, 1.2 mm Cu, SH_a = 115 mm, 40^{o}; 2 sec., linear.

Accuracy of the Tomo Height Display

The hole in the focus test that appears sharply focused is in the tomo plane.

If the hole next to the notch is sharply focused, the numerically selected tomo height SH_a matches the actual tomo height SH; i.e. $\Delta SH_a = 0$.

- If there are differences, determine the difference in height ΔSH_a in mm between the sharply focused hole and notch; there is a difference in height of 2 mm from hole to hole.
  - If the actual tomo height is above the notch, ΔSH_a is positive.
  - If the actual tomo height is below the notch, ΔSH_a is negative.

  Determine the actual tomo height. $\mathbf{SH = SH_a + \Delta SH_a}$
- Calculate the difference in height $\Delta\mathbf{SH_L}$ between the actual tomo height and the line light height: $\Delta\mathbf{SH_L} = \mathbf{SH_L} - \mathbf{SH}$

  The difference between $\Delta\mathbf{SH_a}$ and $\mathbf{SH_L}$ may be max. $\leq$ **5 mm**.

Optical Resolution

Evaluation of the resolution of the tomo exposures is made by comparing them to an exposure made with the Bucky under comparable conditions. In this way, all influences which determine the resolution of a radiographic exposure (focal spot size, screen type, film, geometric relationships, exposure data, etc.) are taken out of consideration and it is possible to make a clear statement about the quality of the tomo device.

- Determine the maximum optical resolution of the tomo exposures and record the results (min. 6x magnifier).
- Determine the maximum optical resolution of the Bucky exposure.

The difference in the maximum optical resolution between the Bucky exposure and the tomo exposures may not be more than one line group. The resolution for the Bucky exposure should result in at least 2.8 Lp/mm (depending on the film-screen system).

If there is more than one line group difference, there intolerable movement problems in the tomo device; it can no longer be said that there is even movement of the tomo device.

NOTICE **If the difference in parallelism between table-stand is more than 3 mm over the complete table length, focus will be affected!**

- The resolution of the tomo exposures must be at least 2 Lp/mm.

Tomo figure and even movement of the tomo device

With a linear layer, the blur patterns of the holes to the left and right of the notch must be parallel; if they are not, the focus plane and film plane are not parallel. This also results in reduced resolution in the line test in a longitudinal direction to the tomo device.

If the blur patterns are jagged (jumpy, wavy lines), there are unsynchronous oscillations in the tomo system (loose or jamming locations, etc.). This also results in reduced resolution.

The blur patterns of the holes should have about the same density over the entire length. When the blur patterns are dotted, there is uneven tomo movement (usually of the catapult Bucky). If there is a continuous change in density of the blur patterns, there is uneven movement speed or there is an uneven dose rate.

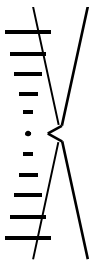
Uneven tomo movement can also be recognized in that the edges of the line test plates do not have a continuous change in density, but are visible as “steps”.

Overall evaluation of the tomo device

Shape and movement of the tomo figure

The blur pattern of the holes in the line test show the form and movement of the tomo figure. If one example is not sufficient for an evaluation, also make a pin-hole exposure as described on Page 6-10 for the particular tomo figure.

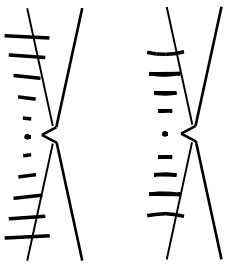
good



Linear layer

The blur patterns of the holes are even and are parallel on both sides of the notch.

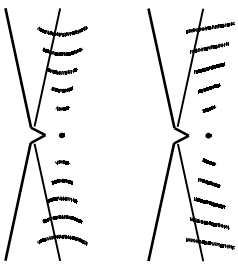
satisfactory



Linear layer

The blur patterns are slightly unparallel or slightly curved.

unsatisfactory

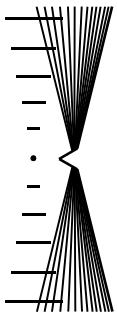


Linear layer

The blur patterns are not parallel or strongly curved and/or very wavy.
The parallelism of table-stand must be improved.

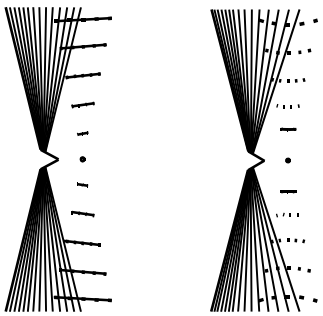
Evenness of blurring

good



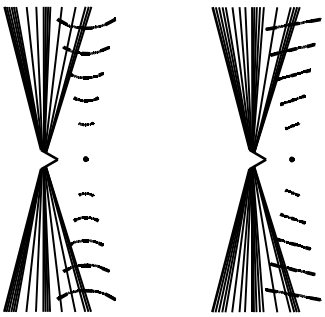
The blur patterns of the holes and edges are continuous and are not dotted or stepped or dotting and stepping is scarcely visible.

satisfactory



The blur patterns show several (4 and more) clearly visible dots or steps.

unsatisfactory



The blur patterns show few (2 to 3) clearly visible dots or steps, so that the "tomo exposure" is comprised virtually of only 2 to 3 oblique exposures made at different beam angles.

8 Changes to Previous Version

Cover sheet:

VERTIX Solitaire added.

Chapter 1, Page 1:

Notice added.

TD PS 21 / Conrad, Tropia